HAINBUCH
SPANNENDE TECHNIK

# Installation manual

Adaptation clamping device
MANDO Adapt T211
MANDO Adapt T212

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**»Translation of the original installation manual«**

# 1 General

## 1.1 Information about this manual

This manual enables safe and efficient handling of the adaptation clamping device.

The manual is a component of the adaptation clamping device and must be kept in the immediate vicinity of the clamping device where it is accessible for personnel at all times. Personnel must have carefully read and understood this manual prior to starting all tasks. The basic prerequisite for safe work is compliance with all the safety instructions and handling instructions in this manual.

Illustrations in this manual are provided for a basic understanding and may deviate from the actual model of the adaptation clamping device.

## 1.2 Description of variants

Three variants of the MANDO Adapt adaptation clamping device are presented in this manual:

- MANDO Adapt T211
- MANDO Adapt T212

If the variants differ in structure, installation, disassembly, and maintenance or fault correction, they will be described separately.
Based on the headers, sections and action steps can always be assigned to a specific variant.

## 1.3 Explanation of symbols

**Safety instructions**

Safety instructions are indicated by symbols in this operating manual. The safety instructions are introduced by signal words that express the scope of the hazard.

The safety instructions must be adhered to, you must act prudently to prevent accidents, personal injury, and material damage.

**DANGER!**
… indicates an imminent dangerous situation that can result in death or serious injury if it is not avoided.

**WARNING!**
… indicates a possible dangerous situation that can result in death or serious injury if it is not avoided.

**CAUTION!**
...indicates a possible dangerous situation that can result in minor or light injury if it is not avoided.

**NOTE!**
...indicates a possible dangerous situation that can result in material damage if it is not avoided.

**Tips and recommendations**

... indicates useful tips and recommendations, as well as information for efficient and trouble-free operation.

## 1.4 Limitations of liability

All information and instructions in this operating manual have been provided under due consideration of applicable standards and regulations, the current state of technology, as well as our many years of experience.

The manufacturer assumes no liability for damage due to:

- Failure to follow the instructions in the manual
- Non-intended use
- Deployment of untrained personnel
- Unauthorized conversions
- Technical changes
- Use of non-approved spare parts

The actual scope of delivery can vary from the explanations and graphic representations provided in this manual in the case of special versions, if supplemental order options are desired, or on the basis of the latest technical changes.

The agreed obligations in the delivery contract, the general terms and conditions, as well as delivery conditions of the manufacturer, and the statutory regulations valid at the time the contract was concluded, apply.

**CAUTION!**
**Danger of injury due to work pieces that are not rotationally symmetric!**
Our adaptation clamping devices are factory-balanced with balance quality G=4 in one plane n=1. All information on rotational balance is based on rotationally symmetric work pieces.

- Do not clamp work pieces that are not rotationally symmetric, only clamp work pieces that are not rotationally symmetric after consulting with the manufacturer.
- Never remove the balance screws and balance weights attached to the adaptation clamping device.

## 1.5 Maximum RPM

**CAUTION!**
**Danger of injury due to the permitted RPM being exceeded!**
The maximum permissible RPM of the adaptation clamping device must be redetermined in every application case, on the basis of the clamping forces required for machining.

- Of all RPMs of the groups specified, always use the lowest RPM.

## 1.6 Copyright

This manual is protected by copyright and is provided exclusively for internal purposes.

Delivery of the operating manual to third parties, duplication in any form – including excerpts – as well as exploitation and/or communication of the content, are not permitted [except for internal use] without written approval from the manufacturer.

Actions to the contrary make damage compensation mandatory. We reserve the right to enforce additional claims.

## 1.7 Scope of delivery

### 1.7.1 MANDO Adapt T211

- MANDO Adapt T211
- Push-off ring
- Draw bolt
- Screws

### 1.7.2 MANDO Adapt T212

- MANDO Adapt T212
- Coupling receptacles
- Support sleeve
- Installation plug from mandrel size 2
- Screws

### 1.7.3 Optional accessories

- Grease / piston grease gun
- Segmented clamping bushing
- SAD segmented clamping bushing
- Work piece end-stop

## 1.8 Spare parts

**WARNING!**
**Safety risk if the wrong spare parts are used!**
Incorrect or defective spare parts can cause damage, malfunction, or total failure; they can also impair safety.

- Only use manufacturer's original spare parts.

Only purchase spare parts from authorized dealers or direct from the manufacturer. Addresses are in the appendix.

## 1.9 Warranty terms

The warranty terms are included in the manufacturer's terms and conditions.

# 2 Safety

This section provides an overview of all the important safety aspects for optimal protection of personnel, as well as for safe and trouble-free operation.

## 2.1 Responsibility of the customer

The adaptation clamping device is used in industrial applications. Consequently the owner of the adaptation clamping device is subject to legal occupational health and safety obligations.

In addition to the safety instructions in this manual, generally valid safety and accident protection guidelines, and environmental protection guidelines must be adhered to and complied with for the area of implementation of the adaptation clamping device.

## 2.2 Personnel requirements

**WARNING!**
**Danger of injury due to insufficient qualification!**
Improper handling of the adaptation clamping device can cause serious injury or material damage.

- Only have activities performed by personnel who are qualified to perform these activities.

The following qualifications are cited in the operating manual for the various activity areas.

- **Specialized personnel**
  are personnel that due to their specialized training, skills, and experience, as well as knowledge of the applicable regulations, are capable of executing the tasks assigned to them and of recognizing and avoiding possible hazards on their own.
- **Hydraulic specialist**
  The hydraulic specialist has been trained for the particular task area in which he is active and is familiar with the relevant standards and regulations.
  Due to his specialized training and experience the hydraulic specialist can perform tasks on hydraulic

equipment and recognize and avoid possible dangers on their own.

Only persons from whom it can be expected that they reliably execute their work are considered as personnel. Persons whose capability to react is impaired, for instance through drugs, alcohol, or medication, are not approved.

- Comply with age-specific and job-specific regulations that are applicable at the installation site when selecting personnel.

## 2.3 Intended use

The adaptation clamping device is designed for installation in a machine tool. Within the machine tool the adaptation clamping device is used exclusively as an attachment for the existing clamping device for quickly extending the maximum clamping diameter.
The adaptation clamping device must only be mounted, operated, maintained, and cleaned by instructed personnel.

Intended use also includes compliance with all the instructions in this manual.

Any use that extends beyond the intended use, or any other use of the adaptation clamping device is considered to be misuse and can cause dangerous situations.

**WARNING!**
**Danger due to misuse!**
Misuse of the adaptation clamping device can cause dangerous situations.

Particularly refrain from the following uses of the adaptation clamping device:

- Adaptation of the MANDO Adapt on clamping devices other than SPANNTOP nova, TOPlus, TOROK, MANOK plus, and HYDROK.
- Use in machines other than machine tools.
- Use in machine tools with technical data other than that specified on the adaptation clamping device.

Claims of any type due to damage arising from non-intended use are excluded.

## 2.4 Personal protective equipment

Wearing of personal protective equipment is required to minimize health hazards when working with the device.

- Always wear the protective equipment necessary for the respective task when working with the device.
- Follow the instructions that have been posted in the work area.

**Always wear**

For all tasks always wear:

**Protective work clothing**

is tight-fitting work clothing with low resistance to tearing, with tight sleeves, and without projecting parts. It is primarily used to protect against entanglement by moving machine parts.

Do not wear rings, chains, or other jewelry.

**Safety footwear**

for protection against heavy falling parts and slipping on slippery substrates.

**For special tasks wear**

Special protective equipment is required when executing special tasks. Separate reference is made to this equipment in the specific sections of this manual. This special protective equipment is explained below:

**Hard hat**

to protect against falling and flying parts and materials.

**Protective goggles**

to protect eyes from flying parts and liquid splashes.

**Protective gloves**

to protect hands from friction, abrasion, puncture wounds, or deeper injuries, as well as from contact with hot surfaces.

## 2.5 Special dangers

In the following section residual risks are cited that occur due to installation of the adaptation clamping device in a machine tool. In each case the residual risks that have been determined based on a risk analysis of the machine must be specified by the customer.

- Follow the safety instructions listed here and the warnings in the other sections of this manual to reduce health hazards and to avoid dangerous situations.

**Moving parts**

**WARNING!**
**Danger of injury due to moving parts!**
Rotating parts of the adaptation clamping device can cause serious injuries.

- Do not reach into moving parts or handle moving parts during operation.
- Pay attention to the clearance of moving parts.
- Do not open covers when the device is in operation.
- Be aware of afterrun time: Prior to opening the covers ensure that all parts have come to a standstill.
- Wear tight-fitting protective work clothing in the danger zone.

## 2.6 Clamping force

The specified maximum radial clamping force can vary due to lubrication condition and the degree of contamination.

## 2.7 Screws

**Moving parts**

**WARNING!**
**Danger of injury due to screws and stud screws being accelerated out of the device!**
Screws and stud screws radially attached to the adaptation clamping device can be accelerated out of the device and cause severe injuries.

- After assembly and maintenance tasks. always retighten all screws and stud screws radially attached on the adaptation clamping with the prescribed tightening torque.
- All screws or stud screws that are not marked with a tightening torque specification are tightened with the prescribed tightening torque in the factory and should only be unscrewed after consultation with the manufacturer.

The tightening torque is shown in the assembly drawing of the adaptation clamping device or it is engraved on the device itself in the direct vicinity of the screw or stud screw.

## 2.8 Environmental protection

> **NOTE!**
> **Environmental hazard due to incorrect handling!**
> Incorrect handling of environmentally hazardous substances, particularly improper disposal, can cause significant environmental damage.
> - Always comply with the instructions cited below.
> - If environmentally harmful substances should inadvertently get into the environment, initiate suitable measures immediately. If in doubt notify the responsible municipal authority about the damage.

The following environmentally harmful substances are used:

**Lubricants**

Lubricants, such as greases and oils can contain toxic substances. Ensure that they do not get into the environment. The device must be disposed of by a specialized disposal company.

To achieve trouble-free operational performance of the adaptation clamping device only use HAINBUCH lubricants. See the Appendix for reference addresses.

# 3 Technical data

## 3.1 General information

| Size | Clamping range | Variant | | Adaptation size | Dimensions [∅ x length in mm] | max. RPM [RPM] | Weight - add-on clamping device [kg] | Clamping force $F_{rad}$ max. [kN] | Draw force $F_{ax}$ max. [kN] |
|---|---|---|---|---|---|---|---|---|---|
| XS | 13-18 | T212 | SE | 52 | ø145 x 125 | 7000 | 3 | 42 | 10 |
| | | | | 65 | ø145 x 128 | 6000 | 4 | | |
| | | | | 100 | ø145 x 139.5 | 5000 | 10 | | |
| | | | RD | 42 | ø125 x 122 | 7000 | 3 | | |
| | | | | 52 | ø125 x 125 | | | | |
| | | | | 65 | ø145 x 135.8 | 6000 | 4 | | |
| | | | | 80 | ø160 x 125 | 5500 | 5 | | |
| | | | | 100 | ø215 x 140 | 5000 | 10 | | |
| S | 16-21 | T212 | SE | 52 | ø125 x 127 | 7000 | 3 | 42 | 10 |
| | | | | 65 | ø145 x 130 | 6000 | 4 | | |
| | | | | 100 | ø 215 x 141.5 | 5000 | 10 | | |
| | | | RD | 42 | ø125 x 124 | 7000 | 3 | | |
| | | | | 52 | ø125 x 127 | | | | |
| | | | | 65 | ø145 x 130 | 6000 | 4 | | |
| | | | | 80 | ø160 x 127 | 5500 | 5 | | |
| | | | | 100 | ø215 x 141.5 | 5000 | 10 | | |

| Size | Clamping range | Variant | | Adaptation size | Dimensions adaptation clamping device [∅ x length in mm] | max. RPM [RPM] | Weight - add-on clamping device [kg] | Clamping force $F_{rad}$ max. [kN] | Draw force $F_{ax}$ max. [kN] |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 20-28 | T211 | SE | 52 | ø125 x 94 | 7000 | 3 | 42 | 10 |
| | | | | 65 | ø144 x 119 | 6000 | 4 | | |
| | | | | 100 | ø215 x 94 | 5000 | 9 | | |
| | | | RD | 42 | ø125 x 106 | 7000 | 4 | | |
| | | | | 52 | ø125 x 109 | | | | |
| | | | | 65 | ø144 x 119 | 6000 | 5 | | |
| | | | | 80 | ø160 x 119 | 5500 | 6 | | |
| | | | | 100 | ø215 x 129 | 5000 | 11 | | |
| | | T212 | SE | 52 | ø125 x 138 | 7000 | 4 | | |
| | | | | 65 | ø145 x 141 | 6000 | 5 | | |
| | | | | 100 | ø215 x 157 | 5000 | 11 | | |
| | | | RD | 42 | ø125 x 135 | 7000 | 4 | | |
| | | | | 52 | ø125 x 138 | | | | |
| | | | | 65 | ø145 x 141.5 | 6000 | 5 | | |
| | | | | 80 | ø160 x 138 | 5500 | 6 | | |
| | | | | 100 | ø215 x 142.5 | 5000 | 11 | | |

| Size | Clamping range | Variant | | Adaptation size | Dimensions adaptation clamping device [∅ x length in mm] | max. RPM [RPM] | Weight - add-on clamping device [kg] | Clamping force $F_{rad}$ max. [kN] | Draw force $F_{ax}$ max. [kN] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 26-38 | T211 | SE | 52 | ø125 x 119 | 7000 | 3 | 42 | 10 |
| | | | | 65 | ø145 x 139 | 6000 | 4 | | |
| | | | | 100 | ø215 x 139 | 5000 | 9 | | |
| | | | RD | 42 | ø125 x 116 | 7000 | 4 | | |
| | | | | 52 | ø125 x 119 | | | | |
| | | | | 65 | ø145 x 129 | 6000 | 5 | | |
| | | | | 80 | ø160 x 129 | 5500 | 6 | | |
| | | | | 100 | ø215 x 139 | 5000 | 11 | | |
| | 26-28 | T212 | SE | 52 | ø125 x 139 | 7000 | 4 | | |
| | | | | 65 | ø145 x 147.5 | 6000 | 5 | | |
| | | | | 100 | ø215 x 158.5 | 5000 | 11 | | |
| | 26-38 | | RD | 42 | ø125 x 136 | 7000 | 4 | | |
| | | | | 52 | ø125 x 139 | | | | |
| | | | | 65 | ø145 x 147.5 | 6000 | 5 | | |
| | | | | 80 | ø160 x 146.5 | 5500 | 6 | | |
| | | | | 100 | ø215 x 158.5 | 5000 | 11 | | |

| Size | Clamping range | Variant | | Adaptation size | Dimensions adaptation clamping device [∅ x length in mm] | max. RPM [RPM] | Weight - add-on clamping device [kg] | Clamping force $F_{rad}$ max. [kN] | Draw force $F_{ax}$ max. [kN] |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 36-54 | T211 | SE | 52 | ø125 x 139 | 7000 | 3 | 85 | 20 |
| | | | | 65 | ø145 x 159 | 6000 | 4 | | |
| | | | | 100 | ø215 x 159 | 5000 | 10 | | |
| | | | RD | 42 | ø125 x 136 | 7000 | 2.5 | | |
| | | | | 52 | ø125 x 139 | | 3 | | |
| | | | | 65 | ø145 x 149 | 6000 | 5 | | |
| | | | | 80 | ø160 x 149 | 5500 | 6 | | |
| | | | | 100 | ø215 x 159 | 5000 | 11 | | |
| | | T212 | SE | 52 | ø125 x 155 | 7000 | 4 | | |
| | | | | 65 | ø145 x 163.5 | 6000 | 5 | | |
| | | | | 100 | ø215 x 174.5 | 5000 | 11 | | |
| | | | RD | 42 | ø125 x 152 | 7000 | 2.5 | | |
| | | | | 52 | ø125 x 155 | | 3 | | |
| | | | | 65 | ø145 x 163.5 | 6000 | 6 | | |
| | | | | 80 | ø160 x 160 | 5500 | | | |
| | | | | 100 | ø215 x 174.5 | 5000 | 11 | | |

| Size | Clamping range | Variant | | Adaptation size | Dimensions adaptation clamping device [∅ x length in mm] | max. RPM [RPM] | Weight - add-on clamping device [kg] | Clamping force $F_{rad}$ max. [kN] | Draw force $F_{ax}$ max. [kN] |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 50-80 | T211 | SE | 65 | ø145 x 159 | 6000 | 5 | 105 | 25 |
| | | | | 100 | ø215 x 169 | 5000 | 10 | | |
| | | | RD | 65 | ø145 x 95 | 6000 | 5 | | |
| | | | | 80 | ø160 x 95 | 5500 | 6 | | |
| | | | | 100 | ø 215 x 95 | 5000 | 11 | | |
| | | T212 | SE | 65 | ø145 x 173 | 6000 | 6 | | |
| | | | | 100 | ø 215 x 181.5 | 5000 | 12 | | |
| | | | RD | 65 | ø145 x 170.5 | 6000 | 5 | | |
| | | | | 80 | ø160 x 168.5 | 5500 | 6 | | |
| | | | | 100 | ø215 x 181.5 | 5000 | 11 | | |

| Size | Clamping range | Variant | | Adaptation size | Dimensions adaptation clamping device [∅ x length in mm] | max. RPM [RPM] | Weight - add-on clamping device [kg] | Clamping force $F_{rad}$ max. [kN] | Draw force $F_{ax}$ max. [kN] |
|---|---|---|---|---|---|---|---|---|---|
| 4 | 70–120 | T211 | SE | 65 | ø145 x 174 | 6000 | 5 | 150 | 35 |
| | | | | 100 | ø215 x 184 | 5000 | 11 | | |
| | | | RD | 65 | ø145 x 110 | 6000 | 6 | | |
| | | | | 80 | ø160 x 110 | 5500 | 8 | | |
| | | | | 100 | ø215 x 110 | 5000 | 11 | | |
| | 70-100 | T212 | SE | 65 | ø145 x 180.5 | 6000 | 8 | | |
| | | | | 100 | ø215 x 191.5 | 5000 | 14 | | |
| | | | RD | 65 | ø145 x 180.5 | 6000 | 8 | | |
| | | | | 80 | ø160 x 176 | 5500 | 9 | | |
| | | | | 100 | ø215 x 191.5 | 5000 | 14 | | |

## 3.2 Operating conditions

**Environment**

| Specification | Value | Unit |
|---|---|---|
| Temperature range | 15 – 70 | °C |

## 3.3 Power specifications

**NOTE!**
**Material damage if the power specifications do not agree!**
If the power specifications of adaptation clamping device and machine do not agree, severe damage extending to total damage can occur to the adaptation clamping device and machine.

- Only clamp adaptation clamping devices in machines with the same power specifications.

Information on maximum clamping force and axial drawtube force is provided on the adaptation clamping device.

## 3.4 Dimension sheet

Dimension sheets for the respective adaptation clamping device can be requested from HAINBUCH.

## 3.5 Type designation

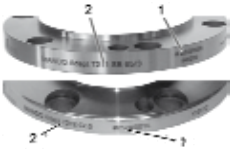



Fig. 1

The type designation is on the adaptation clamping device and includes the following information:

1 ID no. [marked with the # symbol]
2 Type designation and size

# 4 Structure and function

## 4.1 Overview - MANDO Adapt T211 RD

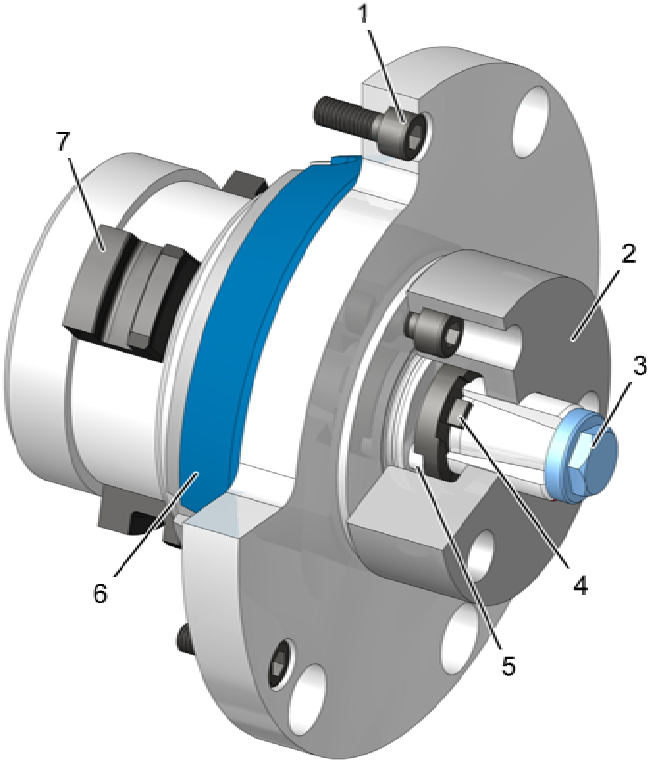



Fig. 2

| | | | |
|---|---|---|---|
| 1 | Mounting screw [3 pc.] | 6 | CENTREX |
| 2 | Standard end-stop | 7 | Coupling |
| 3 | Draw bolt | | |
| 4 | Torsional safety | | |
| 5 | Push-off pins | | |

## 4.2 Overview - MANDO Adapt T211 SE

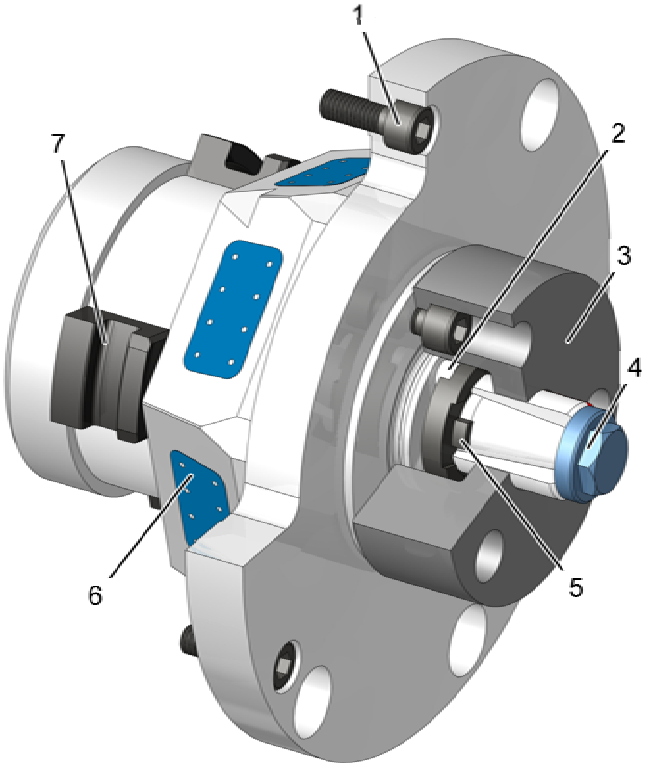



Fig. 3

| | | | |
|---|---|---|---|
| 1 | Mounting screw [3 pc.] | 5 | Torsional safety |
| 2 | Push-off pins | 6 | CENTREX |
| 3 | Standard end-stop | 7 | Coupling |
| 4 | Draw bolt | | |

## 4.3 Overview - MANDO Adapt T212 RD

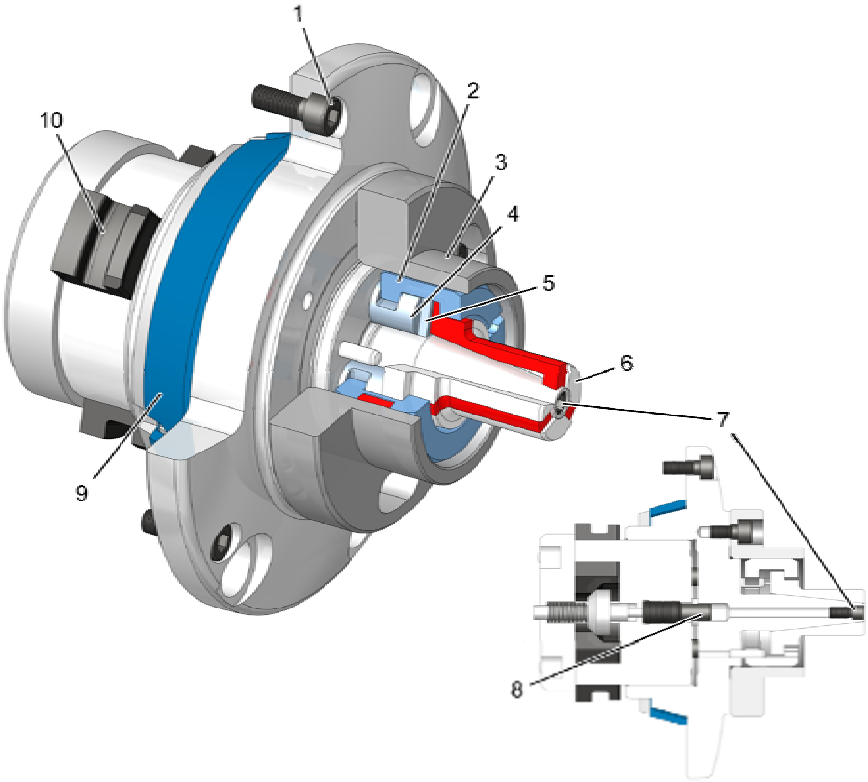



Fig. 4

| | | | |
|---|---|---|---|
| 1 | Mounting screw [3 pc.] | 6 | Segmented clamping bushing |
| 2 | Coupling receptacles | 7 | Screw plug |
| 3 | Support sleeve for SAD segmented clamping bushings | 8 | Locking screw |
| 4 | Coupling carrier | 9 | CENTREX |
| 5 | Torsional safety | 10 | Coupling |

## 4.4 Overview - MANDO Adapt T212 SE

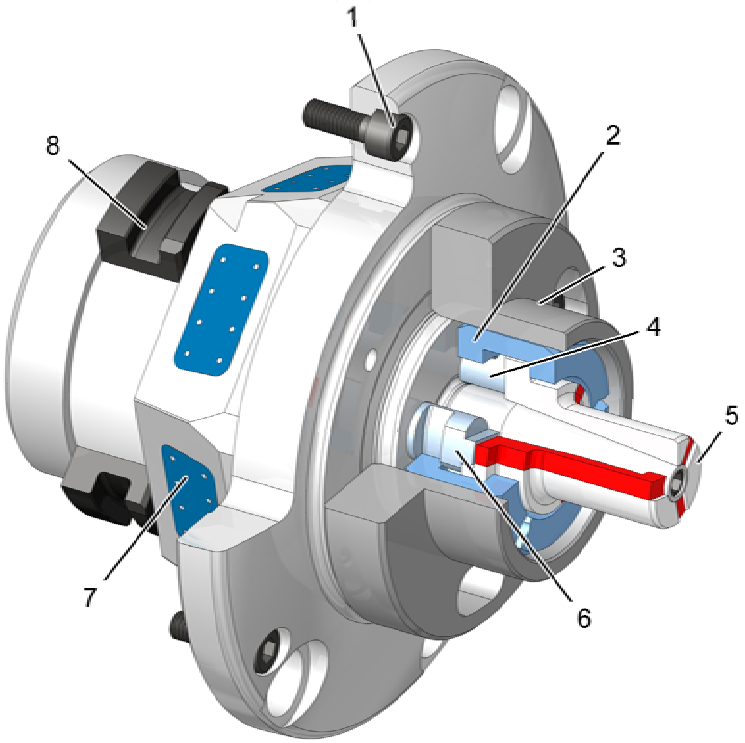



Fig. 5

| | | | |
|---|---|---|---|
| 1 | Mounting screw [3 pc.] | 5 | Segmented clamping bushing |
| 2 | Coupling receptacles | 6 | Torsional safety of the coupling carrier |
| 3 | Support sleeve for SAD segmented clamping bushings | 7 | CENTREX |
| 4 | Coupling carrier | 8 | Coupling |

## 4.5 Brief description of the MANDO Adapt T211/T212

The MANDO Adapt is intended as an optional adaptation mandrel for implementation of I.D. clamping for our clamping devices.

Through use of the MANDO Adapt it is not required to disassemble the respective basic clamping device.
Also the MANDO Adapt does not require additional concentricity alignment.
Our CENTREX interface guarantees repeatability of less than 0.003 mm.
The segmented clamping bushings used are characterized by »parallel work piece clamping«, high accuracy with uniformly minimal deformation of the work piece, as well as fast set-up.

When clamping, due to the effects of the axial draw components, the work piece is pulled tight onto the fixed end-stop. Thus extremely stable clamping of the work piece is achieved even with the shortest clamping lengths.

An additional benefit is the tremendous rigidity of the entire clamping device, which greatly increases the tool life.

MANDO Adapt T211/ T212 can be adapted in the following clamping devices:

- SPANNTOP nova
- TOPlus
- TOROK
- MANOK plus
- HYDROK

## 4.6 Optional accessories

The accessories described here are not part of the shipment. Lubricating grease and grease gun are required for cleaning and preservation of the adaptation clamping device. The lubricating grease is also specially matched for protection of the vulcanized segments of the segmented clamping bushing and increases their service life and elasticity by a significant factor.

### 4.6.1 Lubricating grease

Fig. 6

The universal grease for chuck lubrication is supplied in a 1000 g can. The order number for the universal grease is 2085/0003; it can be ordered from HAINBUCH.

### 4.6.2 Grease gun

Fig. 7

The grease gun is filled with universal grease, which is pressed into the clamping device. The grease gun has a pointed mouthpiece. The order number for the grease gun is 2086/0004; it can be ordered from HAINBUCH.

# 5 Transporting, packaging, and storing

## 5.1 Instructions for transporting

**Improper transportation**

**NOTE!**
**Material damage due to improper transportation!**
If the adaptation clamping device is transported improperly, material damage extending to total failure of the adaptation clamping device can occur.

- Always transport the adaptation clamping device with the utmost caution.
- Do not let the adaptation clamping device fall or expose it to other strong vibration.

## 5.2 Symbols on the packaging

**Fragile**

Identifies packages with fragile or sensitive contents.

Handle the packed goods with care; do not allow them to fall, and do not subject them to impact.

**Protect from moisture**

Keep packed goods dry and protected against moisture.

## 5.3 Transporting inspection

Check delivery immediately upon receipt to ensure that delivery is complete, and to identify any transport damage.

Proceed as follows if there is apparent external damage:

- Do not accept the delivery, or only accept it with reservation.
- Note the scope of transportation damages on the shipping documents or on the freight forwarders delivery papers.
- Submit a complaint.

Report any defect as soon as it is detected. Claims for damage compensation can only be enforced during the applicable periods for giving notice of lack of conformity.

## 5.4 Packaging

**About the packaging**

Individual packages are packed according to the expected transport conditions. Environmentally-friendly materials have been used exclusively for the packaging.

Packaging should protect the specific components from transport damage, corrosion, and other damage until installation. Therefore do not destroy the packaging; remove it just before installation.

The packed goods are sealed in foil airtight and packed in cartons. See the »Technical data« section for the specific weights of the respective sizes.

**Handling packaging materials**

Dispose of packaging materials in accordance with the respectively valid statutory regulations and local guidelines.

**NOTE!**

**Improper disposal causes environmental damage!**

Packaging materials are valuable raw materials and in many cases they can be reused, or they can be effectively treated and recycled.

- Dispose of packaging materials in an environmentally responsible manner.
- Comply with locally applicable disposal guidelines. If necessary commission a specialized company to dispose of packaging.

## 5.5 Storing

Under certain circumstances, instructions for storage and subsequent storage are affixed to the packages that extend beyond the requirements cited here. Comply with these instructions accordingly.

**Storage of packages**

Only store packages under the following conditions:

- Do not store outdoors
- Store in a dry and dust-free location
- Do not expose to aggressive media
- Protect from direct sunlight
- Avoid mechanical vibration
- Storage temperature: 15 to 35°C
- Relative humidity: max. 60%
- For storage periods longer than 3 months:
  - Check the general condition of all parts and the packaging at regular intervals
  - Touch up or re-apply anti-corrosion agents as needed

**Subsequent storage of the adaptation clamping device**

Only re-store the adaptation clamping device under the following conditions:

- Thoroughly clean the adaptation clamping device prior to subsequent storage [see section »Cleaning«]
- Thoroughly oil and grease adaptation clamping device [see section »Cleaning«]
- Pack the adaptation clamping device air-tight in foil

# 6 Installation

## 6.1 Preparations

The total weight of the adaptation clamping device depends on the size and can be as much as 14 kg.

Depending on the weight, to safely lift the adaptation clamping device out of the package and position it in the machine it must be hooked into a crane.

**WARNING!**
**Danger of injury due to falling components!**
When mounting, the adaptation clamping device can fall and cause severe injury and material damage.

- Two people may be required for this task.

### 6.1.1 Preparing the machine tool for assembly

Prior to mounting the MANDO Adapt the base end-stop must be disassembled.

- Required tools:
  - Allen wrench
  - Changing fixture

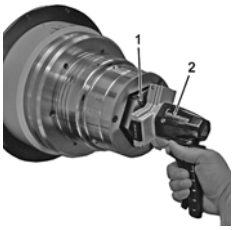



Fig. 8

**1.** Remove the existing clamping head [Fig. 8/1] with changing fixture [Fig. 8/2].

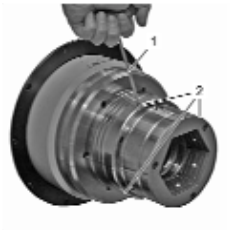



Fig. 9

**2.** Loosen three clamping screws for the base end-stop [Fig. 9/2] of the clamping screw with the Allen wrench [Fig. 9/1].

Fig. 10

**3.** Take off the base end-stop [Fig. 10/1].

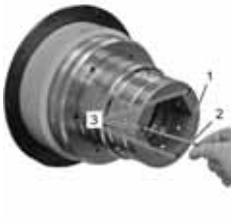



Fig. 11

**4.** Loosen the countersunk screws [Fig. 11/3] on the sheet metal [Fig. 11/1] with the Allen wrench [Fig. 11/2].

**5.** Take off the sheet metal [Fig. 11/1].

## 6.1.2 Preparing the MANDO Adapt T211 adaptation clamping device

Fig. 12

**1.** Unscrew and remove the draw bolt [Fig. 12/1] by hand.

Fig. 13

2. Remove the push-off ring [Fig. 13/1].
3. Clean the MANDO Adapt T211 of fouling with a soft, lint-free cloth.

### 6.1.3 Preparing the MANDO Adapt T212 adaptation clamping device

- Required tools:
  - Allen wrench AF4

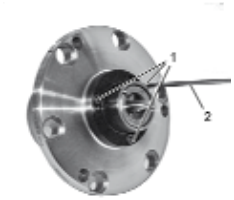



Fig. 14

1. Unscrew the three hex screws [Fig. 14/1] on the support sleeve with SW4 Allen wrench [Fig. 14/2].
2. Turn the support sleeve [Fig. 14/1] counter-clockwise and take it off.

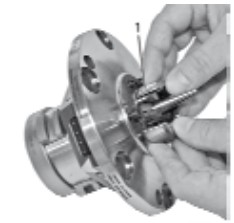



Fig. 15

3. Remove the coupling receptacles [Fig. 15/1].

Fig. 16

**4.** Check whether the locking pin [Fig. 16/1] protrudes on the rear.

If the locking pin protrudes, unscrew the locking screw [Fig. 17/1] until the locking pin no longer protrudes.

Fig. 17

For the smaller sizes the locking screw is on the side [Fig. 17/1], for the larger sizes it is in the middle and inside [Fig. 27/2].

Fig. 18

For the larger sizes in addition the screw plug [Fig. 26/1] [Fig. 27/1] must be removed beforehand in order to reach the inside locking screw [Fig. 27/2] with an Allen wrench.

**5.** Clean the MANDO Adapt T212 of fouling with a soft, lint-free cloth.

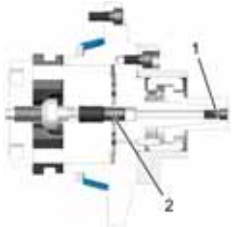



Fig. 19

## 6.2 Assembling the adaptation clamping device

**WARNING!**
**Danger of injury due to unexpected startup of the tool spindle!**
Unexpected start up of the tool spindle can cause severe injury.

- Prior to switching on automatic mode close all protective doors or hoods that are present on the machine tool.
- Unscrew all ring nuts from the adaptation clamping device and remove them from the interior of the machine.
- Only run the machine tool in set-up mode or jog mode.

### 6.2.1 Assembling MANDO Adapt T211

**WARNING!**
**Danger of injury due to vertical hanging spindle!**
Bending into the machine work area when assembling overhead can cause severe head injuries.

- Secure components prior to overhead assembly.
- For assembly on a vertically hanging spindle always use a suitable mounting aid.

- Two people may be required for this task.
- Special tools required:
  - Allen wrench AF5 [M6] for size 42–80
  - Allen wrench AF6 [M7] for size 100

1. Put the machine tool in set up mode.
2. Remove all tools from the interior of the machine.
3. Set the clamping pressure of the machine tool on the lowest setting.
4. Move the drawtube of the machine tool into the front stop position.

Fig. 20

5. Insert MANDO Adapt T211 [Fig. 20/2] in the clamping device [Fig. 20/1]. In this process, ensure that the threaded holes [Fig. 20/3] are flush with the threaded holes on the clamping device [e.g. Fig. 20/arrow].

If the threaded holes for the MANDO Adapt T211 SE are not flush with the threaded holes, remove MANDO Adapt T211 SE again and turn one "segment" further.

Fig. 21

6. Insert the screws [Fig. 21/1] and tighten with the Allen wrench.

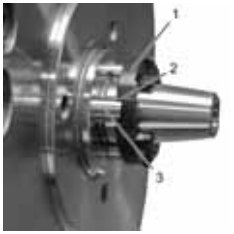


Fig. 22

7. Fit on the push-off ring [Fig. 25/1] and slide it on in the direction of the clamping device. In this process ensure that the apertures on the push-off ring [Fig. 25/2] engage above the push-off pins [Fig. 25/3].

## 6.2.2 Assembling MANDO Adapt T212

**WARNING!**
**Danger of injury due to vertical hanging spindle!**
Bending into the machine work area when assembling overhead can cause severe head injuries.

- Secure components prior to overhead assembly.
- For assembly on a vertically hanging spindle always use a suitable mounting aid.

- Two people may be required for this task.
- Special tools required:
  - Allen wrench AF5 [M6] for size [chuck] 42 - 80
  - Allen wrench AF6 [M7] for size [chuck] 100

1. Put the machine tool in set up mode.
2. Remove all tools from the interior of the machine.
3. Set the clamping pressure of the machine tool on the lowest setting.
4. Move the drawtube of the machine tool into the front stop position.

Fig. 23

5. Insert MANDO Adapt T212 [Fig. 23/2] in the clamping device [Fig. 23/1]. In this process, ensure that the threaded holes [Fig. 23/3] are flush with the threaded holes on the clamping device [e.g. Fig. 23/arrow].

If the threaded holes for the MANDO Adapt T212 SE are not flush with the threaded holes, remove MANDO Adapt T212 SE again and turn one "segment" further.

Fig. 24

**6.** Insert the screws [Fig. 24/1] and tighten with the Allen wrench.

Fig. 25

**7.** Tighten the locking screw [Fig. 25/1] [Fig. 26/1] [Fig. 27/2] with the Allen wrench.

| Size | Wrench size |
|---|---|
| XS to X | AF 4 [M5] [locking screw, exterior] |
| 0 | AF 4 [M5] [locking screw, exterior] |
| | AF 3 [M4] [locking screw, interior] |
| 1 to 4 | AF 5 [M6] [locking screw, exterior] |
| | AF 4 [M5] [locking screw, interior] |

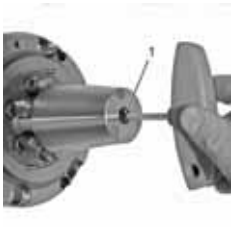



Fig. 26

For the larger sizes, in addition the screw plug [Fig. 27/1] must be removed beforehand in order to reach the inside locking screw [Fig. 27/2] with an Allen wrench.

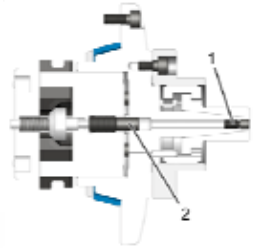



Fig. 27

## 6.2.3 Mount the work piece specific work piece end-stop and segmented clamping bushing on the MANDO Adapt T211

**WARNING!**
**Danger of injury due to improper assembly of the segmented clamping bushing and of the work piece end-stop!**
Improper assembly can result in dangerous situations due to components being accelerated out of the machine.

- Prior to switching on automatic mode close all protective doors or hoods that are present on the machine tool.
- Remove all loose screws and tools from the interior of the machine.
- Only run the machine tool in set-up mode or jog mode.
- Never switch on the machine tool without a work piece being clamped in the machine, or never allow a tool spindle to rotate without a work piece being clamped in the machine.

- Special tools required:
  - Jaw wrench AF13
  - Allen wrench AF4

Fig. 28

**1.** Slide on the segmented clamping bushing [Fig. 28/1].

The groove of the segmented clamping bushing must engage over the torsional safety of the push-off ring.

Fig. 29

**2.** Screw the draw bolt [Fig. 29/1] through the segmented clamping bushing [Fig. 29/2] into the mandrel taper.

Fig. 30

**3.** Tighten the draw bolt [Fig. 30/1] hand tight with jaw wrench AF13 [Fig. 30/2].

Fig. 31

**4.** Fit on work piece specific work piece end-stop [Fig. 31/1] and lock by turning it counter-clockwise.

The work piece specific work piece end-stop is not part of the shipment and must be machined from HAINBUCH GmbH blanks in accordance with the on-site requirements.

Fig. 32

**5.** Tighten work piece specific work piece end-stop [Fig. 32/1] with hex screws [Fig. 32/3] and Allen wrench AF4 [Fig. 32/2] in accordance with the specified torque.

## 6.2.4 Mount the work piece specific work piece end-stop and segmented clamping bushing on the MANDO Adapt T212

**WARNING!**
**Danger of injury due to improper assembly of the segmented clamping bushing and of the work piece end-stop!**
Improper assembly can result in dangerous situations due to components being accelerated out of the machine.

- Prior to switching on automatic mode close all protective doors or hoods that are present on the machine tool.
- Remove all loose screws and tools from the interior of the machine.
- Only run the machine tool in set-up mode or jog mode.
- Never switch on the machine tool without a work piece being clamped in the machine, or never allow a tool spindle to rotate without a work piece being clamped in the machine.

- Special tools required:
  - Allen wrench AF4

Fig. 33

**1.** Slide on the segmented clamping bushing [Fig. 33/1]. In this process, ensure that the pins [Fig. 33/2] on the receptacle are flush with the respective groove [Fig. 33/1] on the segmented clamping bushing.

Fig. 34

**2.** With the palms of your hands press on the segmented clamping bushing [Fig. 34/1] until it rests on the adaptation clamping device.

Fig. 35

**3.** Close the coupling receptacles [Fig. 35/1] over the collar of the segmented clamping bushing [Fig. 35/2] and groove of the coupling carrier [Fig. 35/3] and keep them closed.

Fig. 36

**4.** Fit on the work piece specific work piece end-stop [Fig. 36/1] and slide it over the coupling receptacles [Fig. 36/2].

The work piece specific work piece end-stop is not part of the shipment and must be machined from HAINBUCH GmbH blanks in accordance with the on-site requirements.

Fig. 37

**5.** Lock the work piece specific work piece end-stop [Fig. 37/1] by turning it counter-clockwise.

Fig. 38

**6.** Tighten work piece specific work piece end-stop [Fig. 38/2] with hex screws [Fig. 38/1] and Allen wrench AF4 in accordance with the specified torque.

## 6.3 Tests

**! NOTE!**
**Material damage due to damaged adaptation clamping device!**
A damaged, incomplete, or unbalanced adaptation clamping device can significantly damage or even destroy the machine tool and the work piece.

- Only use complete and properly assembled adaptation clamping devices.
- If in doubt contact the manufacturer.

Ensure the following points prior to each installation and start-up of the adaptation clamping device:

- The adaptation clamping device must be undamaged.
- All Allen screws of the adaptation clamping device must be present and tightened with the proper tightening torque.
- The set RPM of the machine tool should not exceed the maximum permissible speed of the adaptation clamping device.
- The maximum drawtube force specified on the perimeter of the adaptation clamping device must not be exceeded.
- The clamping pressure of the machine must be sufficiently high.
- All assembly tools must be removed from the interior of the machine.

- Adaptation clamping device and work piece must be compatible.
- The work piece must be clamped into the adaptation clamping device with sufficient work piece tension.

## 6.4 Activities after production is concluded

1. Move the clamping device into unclamped position.
2. Switch off the machine tool and safeguard it from being switched on again.
3. Open the protective door or hood.
4. Clean the clamping device of chips and production residues with a soft, lint-free cloth.
5. Close the protective door or hood.

# 7 Disassembly, subsequent storage, and disposal

If there is a break in production that lasts longer than 3 days, or if the machine will be changed over for other work pieces, the adaptation clamping device must be disassembled and properly stored in accordance with the manufacturer's specifications [see the section, »Transportation, packaging, storage«].

Prior to disassembling:

- Put the machine in set up mode.
- Remove fuels and auxiliary materials, as well as residual processing materials and dispose of these items in an environmentally-responsible manner.

## 7.1 Safety

**Safeguarding against restart**

**DANGER!**
**Life-threatening danger if restarted without authorization!**
When disassembling there is danger of the energy supply being switched on inadvertently. This poses a life-threatening hazard for persons in the danger zone.

- Prior to starting the tasks switch off all energy supplies and safeguard them from being switched on again.

## 7.2 Disassembling MANDO Adapt T211

**WARNING!**
**Danger of injury due to vertical hanging spindle!**
Bending into the machine work area when disassembling overhead can cause severe head injuries.

- Secure components prior to overhead disassembly.
- For disassembly on a vertically hanging spindle always use a suitable mounting aid.

- Special tools required:
  - Allen wrench AF4
  - Jaw wrench AF13

Fig. 39

1. Put the machine tool in set up mode.
2. Loosen three screws [Fig. 39/3] on the work piece specific base end-stop [Fig. 39/1] with the Allen wrench [Fig. 39/2].

Fig. 40

3. Unlock the work piece specific base end-stop [Fig. 40/1] by turning it counter-clockwise and take it off.

Fig. 41

**4.** Loosen the draw bolt [Fig. 41/1] with jaw wrench AF13 [Fig. 41/2] and remove it.

Fig. 42

**5.** Pull off the segmented clamping bushing [Fig. 42/1] and push-off ring [Fig. 42/2].

Fig. 43

**6.** Unscrew three screws [Fig. 43/1] with AF 4 Allen wrench.

**7.** Take MANDO Adapt T211 out of the clamping device.

If the MANDO Adapt T211 cannot be removed from the clamping device, it must be manually unlocked [section »Manually unlocking MANDO Adapt T211/T212«].

## 7.3 Disassembling MANDO Adapt T212

**WARNING!**
**Danger of injury due to vertical hanging spindle!**
Bending into the machine work area when disassembling overhead can cause severe head injuries.

- Secure components prior to overhead disassembly.
- For disassembly on a vertically hanging spindle always use a suitable mounting aid.

- Special tools required:
  - Allen wrench AF5 [M6] for size [chuck] 42 - 80
  - Allen wrench AF6 [M7] for size [chuck] 100

Fig. 44

1. Put the machine tool in set up mode.
2. Loosen three screws [Fig. 44/1] on the work piece specific base end-stop [Fig. 44/2] with the Allen wrench AF4.

Fig. 45

3. Unlock the work piece specific base end-stop [Fig. 45/1] by turning it counter-clockwise and take it off.

Fig. 46

**4.** Open coupling receptacles [Fig. 46/1] and take them off.

Fig. 47

**5.** Pull off the segmented clamping bushing [Fig. 47/1].

Fig. 48

Fig. 49

**6.** Loosen the locking screw [Fig. 48/1] [Fig. 49/1] with the Allen wrench.

| Size | Wrench size |
|---|---|
| XS to X | AF 4 [M5] [locking screw, exterior] |
| 0 | AF 4 [M5] [locking screw, exterior] |
| | AF 3 [M4] [locking screw, interior] |
| 1 to 4 | AF 5 [M6] [locking screw, exterior] |
| | AF 4 [M5] [locking screw, interior] |

**7.** Take MANDO Adapt T212 out of the clamping device.

Fig. 50

**8.** Unscrew three screws [Fig. 50/1] with Allen wrench.

**9.** Take MANDO Adapt T212 out of the clamping device.

If the MANDO Adapt T212 cannot be removed from the clamping device, it must be manually unlocked [section »Manually unlocking MANDO Adapt T211/T212«].

## 7.4 Subsequent storage of the adaptation clamping device

The adaptation clamping device must be cleaned and treated with corrosion protection for subsequent storage [see section »Cleaning«].

The storage conditions are specified in the section »Transport, packing, and storing«.

## 7.5 Disposal

If a return or disposal agreement has not been concluded, then recycle disassembled components.

**NOTE!**
**Improper disposal causes environmental damage!**
Lubricants and other auxiliary materials are subject to treatment as special waste, and should only be disposed of by approved specialist companies!

Local municipal authorities or specialized disposal companies provide information on environmentally-responsible disposal.

# 8 Maintenance

**Environmental protection**

Comply with the following instructions for environmental protection when performing maintenance work:

- At all lubricating points where lubricant is applied by hand, remove escaping, used, or excess grease, and dispose of it in accordance with applicable local regulations.
- Collect used oil in suitable containers and dispose of it in accordance with applicable local regulations.

## 8.1 General instructions for cleaning

The prerequisite for achieving concentricity and face-runout tolerances is cleanliness of the corresponding end-stop or guide diameter. Always clean these surfaces with an appropriate cleaner.

**CAUTION!**
**Danger of injury due to improper handling of cleaners!**
Improper handling of cleaners can cause health impairments.

- Always comply with the safety data sheets and guidelines provided by the manufacturer of the cleaning agent for handling/using the cleaners.

**CAUTION!**
**Danger of injury due to loss of clamping force!**
Fouling of the adaptation clamping device can cause the adaptation clamping device to lose considerable clamping force.

- Always comply with the maintenance and cleaning intervals specified in this manual.
- In conjunction with the maintenance intervals, regularly check the maintenance status of the adaptation clamping device through clamping force measurements.

**NOTE!**
**Material damage due to use of the wrong cleaning agent/cleaner!**
Seals and clamping elements can be damaged due to use of the wrong seals and clamping elements.
- Do not use any solvents that contain ester or polar solvents for cleaning purposes.

## 8.2 Cleaning

**NOTE!**
**Material damage if cleaned with compressed air!**
Cleaning the adaptation clamping device with compressed air can force metal chips into thread and grooves. This can damage or even destroy the adaptation clamping device.
- Never clean the adaptation clamping device with compressed air.

- Auxiliary material required:
  - Ester-free, non-polar cleaning agent
  - Soft, lint-free cloth

1. Clean all the components listed below with cleaning agent and a cloth; remove all oil and grease residues.

## 8.3 Preserving the adaptation clamping device

- Execution only by a specialist.
- Special tools required:
  - Universal grease 2085/0003
  - Oil stone
  - Soft, lint-free cloth

Fig. 51

1. Disassemble the adaptation clamping device [see section »Disassembly, subsequent storage, disposal«.
2. Hone all the bearing surfaces of the adaptation clamping device with an oil stone.
3. Lightly grease all cylinder screws [Fig. 51]. Remove excess grease with a soft, lint-free cloth.

4. Screw all cylinder screws [Fig. 51] back into the adaptation clamping device and tighten them hand tight.
5. Lightly grease all interior and outer surfaces of the adaptation clamping device. Remove excess grease with a soft, lint-free cloth.
6. Store the adaptation clamping device in airtight foil. Place it on a level, impact-free surface and safeguard it from falling.

## 8.4 Maintenance schedule

Maintenance tasks are described in the sections below that are required for optimal and trouble-free operation.

If increased wear is detected during regular inspections, then reduce the required maintenance intervals according to the actual indications of wear.

Contact the manufacturer, [see the service address on the back] if you have questions concerning maintenance tasks and intervals.

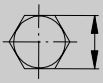
| Interval | Maintenance task |
|---|---|
| Daily | Visual inspection and complete cleaning in case of heavy contamination [see section »Cleaning«] |
| Weekly | Clean the adaptation clamping device [see section »Cleaning«] |

## 8.5 Bolt torque

**Metric ISO thread**

The guide values for bolt tightening torque for achieving the highest permissible pre-tension for metric ISO thread are specified in Nm in the table.

- Total friction coefficient $\mu_{tot} = 0.12$
- 90% utilization of the apparent limit of elasticity

| Diameter |  [mm] | [mm] | Torque for screw quality 10.9 [Nm] |
|---|---|---|---|
| M 4 | 7 | 3 | 4 |
| M 5 | 8 | 4 | 7 |
| M 6 | 10 | 5 | 12 |
| M 8 | 13 | 6 | 25 |
| M 10 | 17 | 8 | 50 |
| M 12 | 19 | 10 | 100 |
| M 16 | 24 | 14 | 220 |
| M 20 | 30 | 17 | 400 |
| M 24 | 36 | 19 | 600 |

The table shows the maximum permissible values and does not include any other safety factors. Knowledge of the applicable guidelines and configuration criteria are the prerequisites.

# 9 Troubleshooting

Possible fault causes and the tasks to correct these faults are described in the following section.

If there are faults that cannot be corrected through the instructions below, contact the manufacturer, see service address on the back of this operating manual

## 9.1 Safety

**Troubleshooting**

The following always applies:

1. For faults that pose a direct danger for personnel and or property immediately execute the emergency-stop function.
2. Determine the cause of the fault.
3. If correction of the fault requires work in the danger zone, put the machine in set-up mode.
4. Immediately inform the responsible parties at the installation site of the fault.
5. Depending on the type of fault, either have authorized specialized personnel correct the fault, or correct it yourself.
6. If there is a fault that was not caused by the adaptation clamping device the cause of the fault may be in the machine area. See the operating manual for the machine in this regard.

## 9.2 Trouble shooting table

The faults and causes described in the fault table are based both on the adaptation clamping device as well as the adapted adaptation clamping device.

| Fault | Possible cause | Fault correction | Corrected by |
|---|---|---|---|
| Adaptation clamping device cannot be replaced | Adaptation clamping device not unlocked | Unlock adaptation clamping device [see section »Manually unlocking MANDO Adapt T211/T212«]. | Specialist |
| Clamping force is too low | Work piece is under-dimensioned | Replace with a suitable segmented clamping bushing. | Specialist |
| | Insufficient hydraulic pressure on the clamping cylinder | Check the machine-side hydraulic unit. | Hydraulic specialist |
| | Defective clamping cylinder or blocked drawtube | Contact the machine manufacturer. | Machine manufacturer |
| Eccentric dimensional deviation on the work piece | Concentricity error of the clamping unit | Check the concentricity on the clamping taper and correct if necessary. | Specialist |
| Dimensional deviation on the work piece | Contaminated clamping taper | Take out the adaptation clamping device and clean the clamping taper of the clamping device. | Specialist |

| Fault | Possible cause | Fault correction | Corrected by |
|---|---|---|---|
| Formal defect on the work piece | Elastic deformation of feedstock that is subject to formal defects. After machining, the work piece returns to its original form. | Use feedstock with fewer formal defects. | Specialist |
| Marks on the clamping area | Excessive dimensional difference between the work piece diameter and the clamping diameter. | Replace with a segmented clamping bushing with the suitable clamping diameter. | Specialist |

## 9.3 Manually unlocking MANDO Adapt T211/T212

**WARNING!**
**Danger of injury due to vertical hanging spindle!**
Bending into the machine work area when disassembling overhead can cause severe head injuries.

- Secure components prior to overhead disassembly.
- For disassembly on a vertically hanging spindle always use a suitable mounting aid.

- Two people are required for this task
- Special tools required:
  - Allen wrench
  - Jaw wrench AF13
  - Crane/ring bolt from size 80 of the clamping device

Fig. 52

1. Safeguard the clamping device against falling as specified in the assembly manual/information in section »Disassembling«.
2. Unscrew six screws [Fig. 52/1] on the clamping device with Allen wrench.
3. Take off and unscrew clamping device with MANDO Adapt T211 or T212.

Fig. 53

4. Press in the locking pin [Fig. 53/1] on the rear.

> The illustrations provided here provide a general understanding of the procedure and for identification of the locking pin. Pressing in the locking pin is executed from the rear through the clamping device that is still mounted on the MANDO Adapt.

5. Remove MANDO Adapt T211 or MANDO Adapt T212 from the clamping device.

## 9.4 Start-up after corrected fault

After correcting the fault execute the following steps to start up again:

1. Reset the emergency-stop devices.
2. Acknowledge the fault on the machine tool controller.
3. Ensure that that no one is in the danger zone.
4. Start the machine tool.

# 10 Appendix

## 10.1 Service Hotline

**Order Hotline**

Quickly ordered and delivered. A call is all it takes:
+49 [0]7144. 907-333

**Schedule Hotline**

Current status of your order? Just call:
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**24h emergency call**

Has there been a crash or other technical emergency?
Our experts are at your service around the clock:
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## 10.2 Representatives in Germany and Europe

The sales partners and service employees listed below are available for further consultation or support.

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|---|---|---|---|---|
| J 010 – 049 | B 370 – 399 | N 600 – 659 | H 800 – 839 | N 970 – 989 |
| M 060 – 089 | C 400 – 479 | E 660 – 699 | G 840 – 851 | O 979 |
| J 090 – 189 | A 480 – 499 | L 700 – 709 | H 852 – 866 | M 980 – 999 |
| I 190 – 289 | C 500 – 509 | O 710 – 719 | L 867 | |
| B 290 – 319 | F 510 – 549 | D 720 – 729 | H 868 – 879 | |
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